

CHROMOSOME NUMBERS OF GLANDULARIA (VERBENACEAE) FROM CENTRAL AND TRANS-PECOS, TEXAS

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ABSTRACT

Meiotic chromosome counts for 66 populations of the genus *Glandularia* (sensu Umber 1979) are reported, all from the state of Texas. These include counts for the following taxa: *G. bipinnatifida* var. *bipinnatifida* ($n = 15$ pairs); *G. bipinnatifida* var. *brevispicata* ($n = 15$ pairs); *G. pumila* ($n = 10$ pairs); *G. quadrangulata* ($n = 10$ pairs); *G. racemosa* ($n = 10$ pairs); *G. verecunda* ($n = 10$ pairs); and *G. wrightii* ($n = 10$ pairs). The taxonomic import of these data is discussed.

RESUMEN

Se publican los recuentos cromosómicos en meiosis de 66 poblaciones del género *Glandularia* (sensu Umber 1979), todos del estado de Texas. Se incluyen recuentos de los siguientes taxa: *G. bipinnatifida* var. *bipinnatifida* ($n = 15$); *G. bipinnatifida* var. *brevispicata* ($n = 15$); *G. pumila* ($n = 10$); *G. quadrangulata* ($n = 10$); *G. racemosa* ($n = 10$); *G. verecunda* ($n = 10$); y *G. wrightii* ($n = 10$). Se discute la importancia taxonómica de estos datos.

Glandularia is a difficult genus, as well noted by Umber (1979) in his systematic treatment of the group, and by both Henrickson (2003) and Turner (2003) in their running accounts of several taxa. In his efforts to utilize cytological data in evaluating taxonomic groupings, Umber summarized previous counts for the genus, this amounting to 47 reports for 20 species, including 10 of his own. Subsequently, few additionally counts have been forthcoming, although Poggio et al. (1993), without reference to Umber's work, noted that the genus is amphitropical in distribution, those of South America possessing mostly diploid taxa ($2n = 10$ or $2x = 5$), those of North America mostly hexaploid ($2n = 30$ or $6x = 30$). Actually, of the North American taxa of *Glandularia* counted to date (ca. 20 species), half are tetraploids ($4x = 20$), and half are hexaploids ($6x = 30$); no diploids have been reported, suggesting a South American origin for the group, as first noted by Schnack (1964).

In the present account we provide chromosome counts for an additional 66 populations from six species, all of these from Texas, as summarized in Table 1. We subsequently discuss the import of these data according to the treatment of Umber.

TABLE 1. Chromosome counts of *Glandularia* (sensu Umber 1979).***Glandularia bipinnatifida* (Nutt.) Nutt. var. *bipinnatifida*:** all counts $n=15$ pairs.

Brewster Co.: 0.5 mi S of Alpine, *Powell* 6415 (SRSC).
 Brewster Co.: 1 mi S of Alpine, *Powell* 6416 (SRSC).
 Brewster Co.: 1.4 mi S of Alpine, *Powell* 6417 (SRSC).
 Brewster Co.: 9 mi SE of Alpine, *Powell & Powell* 6429 (SRSC).
 Brewster Co.: 6 mi N of Alpine, *Powell & Powell* 6431 (SRSC).
 Brewster Co.: 3 mi W of Alpine, *Turner* 24-157 (SRSC, TEX).
 Brewster Co.: 14 mi NE of Marathon, *Turner* 24-168 (SRSC, TEX).
 Crockett Co.: ca. 15 mi W of Ozona, *Turner* 24-532 (SRSC, TEX).
 Culberson Co.: ca. 18 mi W of Orla, *Turner* 24-370 (SRSC, TEX).
 Hudspeth Co.: 6.1 mi W of Sierra Blanca, *Turner* 24-184 (SRSC, TEX).
 Hudspeth Co.: Allamoore exit, IH 10, ca. 20 mi E of Sierra Blanca, *Turner* 24-318 (SRSC).
 Jeff Davis Co.: 0.1 mi along Farm Rd 2017 from Hwy. 90, *Turner* 24-554 (SRSC, TEX).
 Kimble Co.: ca. 3.6 mi along old Segovia Road from IH-10, *Turner* 24-221 (SRSC, TEX).
 Pecos Co.: ca. 3 mi W of Longfellow, *Rodriguez & Turner* 24-201 (SRSC, TEX).
 Pecos Co.: ca. 4 mi NW of Longfellow, *Rodriguez & Turner* 24-202B (SRSC, TEX).
 Pecos Co.: ca. 27 mi S of Fort Stockton, *Turner* 24-169 (SRSC, TEX).
 Pecos Co.: 23 mi S of Fort Stockton, *Turner* 24-179 (SRSC, TEX).
 Pecos Co.: 2.1 mi N of Fort Stockton, *Powell & Powell* 6436 (SRSC).
 Pecos Co.: 2 mi SE of Fort Stockton, *Powell & Powell* 6438 (SRSC).
 Pecos Co.: 1.5 mi S of Fort Stockton, *Powell & Powell* 6440 (SRSC).
 Pecos Co.: N part of Fort Stockton, *Powell & Powell* 6443 (SRSC).
 Pecos Co.: ca. 15 mi E of Bakersfield, *Turner* 24-444 (SRSC, TEX).
 Presidio Co.: ca. 22 mi W of Marfa, *Turner* 24-183 (SRSC, TEX).
 Presidio Co.: ca. 20 mi S of Marfa, *Turner* 24-277 (SRSC, TEX).
 Reeves Co.: 2 mi E of Balmorhea, *Turner* 24-226 (SRSC, TEX).
 Sutton Co.: 6 mi W of Sonora, *Turner* 24-223 (SRSC, TEX).

Glandularia bipinnatifida* var. *brevispicata Umber: all counts $n=15$ pairs.

Culberson Co.: ca. 2 mi W of Guadalupe Mts. Natl. Park, *Turner* 24-228 (SRSC, TEX).
 Culberson Co.: 3 mi along Hwy. 652 from its juncture with US 180, *Turner* 24-242 (SRSC, TEX).
 Culberson Co.: roadside park just W of Guadalupe Mts. Natl. Park, *Turner* 24-254 (SRSC, TEX).

***Glandularia pumila* (Rydb.) Umber:** all counts $n=10$ pairs.

Brewster Co.: ca. 5 mi W of Alpine, *Turner* 24-141 (SRSC).
 Crockett Co.: above Fort Lancaster, *Turner* 24-32 (TEX).

***Glandularia quadrangulata* (Heller) Umber:** all counts $n=10$ pairs.

Crockett Co.: ca. 5 mi due N of Sheffield, *Turner* 24-72 (SRSC, TEX).
 Crockett Co.: where Hwy. 1973 crosses into Val Verde Co., *Turner* 24-145 (SRSC, TEX).

***Glandularia racemosa* (Eggert) Umber:** all counts $n=10$ pairs.

Brewster Co.: Dog Flats, Big Bend Natl. Park, *Powell et al.* 6406 (SRSC).
 Brewster Co.: 5.6 mi S along Hwy. 385 from intersection with Hwy. 2627, *Turner* 24-51 (SRSC, TEX).
 Brewster Co.: 6 mi E of Marathon, *Turner* 24-142 (SRSC, TEX).
 Pecos Co.: 9 mi W of Fort Stockton, *Turner* 24-29 (SRSC, TEX).
 Pecos Co.: 3.5 mi E of Fort Stockton, *Turner* 24-30 (SRSC, TEX).
 Pecos Co.: 2.2 mi along Hwy. 67 from IH-10, *Turner* 24-43 (SRSC, TEX).
 Pecos Co.: 11.5 mi SE of Imperial, *Turner* 24-59 (SRSC, TEX).
 Pecos Co.: 6 mi S of Fort Stockton, *Turner* 24-180 (SRSC, TEX).

TABLE 1. continued

Glandularia verecunda Umber: all counts $n = 10$ pairs.

Brewster Co.: Dog Flats, Big Bend Natl. Park, Powell *et al.* 6405 (SRSC).
 Brewster Co.: 10 mi N of Panther Junction, Big Bend Natl. Park, Powell *et al.* 6412 (SRSC).
 Brewster Co.: 5.6 mi S along Hwy. 385 from intersection with Hwy. 2627, Turner 24-50 (SRSC, TEX).
 Pecos Co.: 9 mi W of Fort Stockton along IH-10, Turner 24-28 (SRSC, TEX).
 Pecos Co.: 3.5 mi E of Fort Stockton, Turner 24-30 (SRSC, TEX).
 Pecos Co.: 2.2 mi along Hwy. 67 from IH-10, Turner 24-44 (SRSC, TEX).
 Pecos Co.: 0.3 mi from Pecos River along Hwy. 67, Turner 24-66A (SRSC, TEX).
 Pecos Co.: 2 mi S along Hovey road from IH-10, Turner 24-121 (SRSC, TEX).

Glandularia wrightii (A. Gray) Umber: all counts $n = 10$ pairs.

El Paso Co.: Franklin Mts., ca. 8 mi N of El Paso, Loop Road, Fusselman Mt. Canyon trailhead, M. Turner 107 (SRSC).
 Brewster Co.: Panther Junction, Big Bend Natl. Park, Fenstermacher s.n. (SRSC).
 Brewster Co.: Panther Pass, Big Bend Natl. Park, Fenstermacher s.n. (SRSC).
 Brewster Co.: 9 mi SE of Alpine, Powell 6414 (SRSC).
 Brewster Co.: ca. 5 mi S of Alpine, Powell 6418 (SRSC, TEX).
 Brewster Co.: 9 mi SE Alpine, Powell & Powell 6430 (SRSC).
 Brewster Co.: 6 mi N of Alpine, Powell & Powell 5432 (SRSC).
 Brewster Co.: ca. 5 mi W of Alpine, Turner 24-156 (SRSC, TEX).
 Brewster Co.: Turner Canyon, 5 mi W Alpine, Turner 24-429 (SRSC).
 Brewster Co.: 32 mi S of Alpine, Turner 24-159 (SRSC, TEX).
 Jeff Davis Co.: ca. 8 mi NW of Fort Davis, Hedges 75 (SRSC).
 Jeff Davis Co.: 4 mi S of Fort Davis, Powell *et al.* 6433 (SRSC).
 Jeff Davis Co.: Davis Mts. State Park, Turner 24-200 (SRSC, TEX).
 Jeff Davis Co.: ca. 20 mi E of Fort Davis, Turner 24-227 (SRSC, TEX).
 Presidio Co.: ca. 20 mi S of Marfa, S. Powell 22 (SRSC).
 Presidio Co.: ca. 14 mi S of Marfa, Turner 24-288 (SRSC, TEX).
 Presidio Co.: ca. 23 mi S of Marfa, Turner 24-289 (SRSC, TEX).

Glandularia bipinnatifida var. **bipinnatifida**

Umber reported chromosome counts for 18 collections of this taxon from over a broad range. Fifteen of these were listed as $n = 15$ pairs; three with $n = 10$ pairs. The latter counts, as noted below, perhaps relate to *G. wrightii*. We report herein counts for an additional 26 collections of *G. b.* var. *bipinnatifida*, all with $n = 15$ pairs.

Glandularia bipinnatifida var. **breviscapa**

Umber reported a single collection (the Type) of this taxon as $n = 15$ pairs. We have added three additional counts from the Guadalupe Mts. of Culberson Co., Texas, all with $n = 15$ pairs.

Glandularia pumila

Umber reported only two counts for this taxon, both by Lewis and Oliver (1961) from Central Texas, and both with $n = 10$ pairs. We report here two additional counts from western Texas, both having the same number.

Glandularia quadrangulata

Umber listed a single count of $n = 10$ pairs for this taxon, as first reported by Lewis and Oliver (1961) from a population in southern Texas. We report two additional collections, both with $n = 10$ pairs.

Glandularia racemosa

Umber reported counts of only two collections of this taxon, an unvouchered count of $n = 15$ pairs by Derman (1936), and a count of $n = 15$ pairs by Umber himself, the latter from Pecos Co., Texas. On the basis of these two reports Umber reckoned the taxon to be a hexaploid ($6x = 30$). We present here counts from eight Texas populations, including the populational site from which Umber obtained his count of $n = 15$ pairs. All proved to be tetraploids ($4x = 40$).

It would appear that *G. racemosa* is not a hexaploid as previously reported; both Umber (1979) and Henrickson (2003) used such data to bolster their acceptance of *G. racemosa* as a valid species, as opposed to its submergence under *G. quadrangulata* as originally proposed by Turner (1998). Actually, morphological characters alone will serve to distinguish *G. racemosa* from *G. quadrangulata* (Turner, in prep.).

Glandularia wrightii

Umber reported counts of three collections of this taxon, all with $n = 10$ pairs. He acknowledged its close relationship to *G. bipinnatifida* (so far as known a hexaploid) but noted its consistently tetraploid chromosome number, and seeming restriction to the higher portions of the Chisos, Davis, and Franklin mountains of Trans-Pecos, Texas. The only exceptional counts for *G. bipinnatifida* (i.e., $n = 10$ pairs) reported by Umber are three: two from Texas (El Paso and Pecos counties) and one from Arizona (Apache Co.). Interestingly, two of the latter were identified by their collectors as *G. wrightii*. Regardless, we present here counts for 17 collections of *G. wrightii*, all tetraploid with $n = 10$ pairs. The species often grows in close proximity to *G. bipinnatifida* without showing signs of hybridization, although putative first generation hybrids would be exceedingly difficult to detect without cytological data. Nevertheless, field observations and chromosomal data assembled by the present authors strongly suggest that *G. wrightii* is a good biological species, contrary to the views of Turner (1998) who treated it as synonymous with his concept of *G. bipinnatifida* var. *ciliata* (Benth.) B.L. Turner.

MATERIALS AND METHODS

All counts were obtained from meiotic material collected in the field; preservation and staining procedures follow the methods outlined by Powell and Weedin (2001).

ACKNOWLEDGMENTS

We are grateful to Joselyn Fenstermacher for the collection of buds from Big Bend National Park, and to Matt Turner for buds from El Paso Co. Ray Umber provided helpful review comments.

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